CLAIMS

We claim as our invention:

1. A method of manufacturing an insulated component, the method comprising:

providing a substrate having a surface;

depositing a layer of ceramic insulating material on the substrate surface; and

forming a continuous gap in a top surface of the layer of ceramic insulating material to define segments therein, the continuous gap having a width at the top surface of less than 100 microns.

2. The method of claim 1, further comprising forming the continuous gap to have a width of less than 75 microns.

3. The method of claim 1, further comprising forming the continuous gap to have a width of less than 50 microns.

4. The method of claim 1, further comprising forming the continuous gap to have a depth that does not extend through an entire thickness of the layer of ceramic insulating material.

5. The method of claim 1, further comprising forming the continuous gap using a laser engraving process.

6. The method of claim, 1, further comprising:

forming a first plurality of continuous gaps to a first depth into the layer of ceramic insulating material; and

forming a second plurality of continuous gaps to a second depth into the layer of ceramic insulating material.

7. The method of claim 1, further comprising forming the continuous gap by:

exposing the top surface to a first pass of laser energy having a first parameter to form the continuous gap; and

exposing the continuous gap to a second pass of laser energy having a second parameter different than the first parameter to change a geometry of the continuous gap.

8. The method of claim 7, wherein the second pass of laser energy has a wider beam footprint than that of the first pass of laser energy.

9. The method of claim 7, wherein the second pass of laser energy has a pulsation frequency that is greater than that of the first pass of laser energy.

10. The method of claim 1, further comprising forming the continuous gap using laser energy delivered through a fiber optic cable.

11. The method of claim 1, further comprising forming the continuous gap with a laser engraving process using a lens having a focal length of at least 160 mm in order to reduce accumulation of molten material splashed onto the lens during the laser engraving process.

12. The method of claim 1, further comprising forming the continuous gap to follow a direction of a fluid stream over the top surface when the component is in use.

13. The method of claim 1, further comprising forming a plurality of continuous gaps in the top surface at a spacing between adjacent gaps of less than 750 microns.

14. The method of claim 13, further comprising forming the plurality of continuous gaps in the top surface at a spacing between adjacent gaps of less than 500 microns.

15. The method of claim 13, further comprising forming the plurality of continuous gaps in the top surface at a spacing between adjacent gaps in a range of 500-750 microns.

16. The method of claim 1, further comprising:

depositing a first layer of ceramic insulating material on the substrate surface;

forming a first plurality of continuous gaps in a top surface of the first layer;

depositing a second layer of ceramic insulating material on the top surface of the first layer; and

forming a second plurality of continuous gaps in a top surface of the second layer.

17 The method of claim 16, further comprising forming each of the gaps in the top surface of the second layer to have a width at the top surface of less than 100 microns.

18. A method of manufacturing an insulated component, the method comprising:

providing a substrate having a surface;

depositing a layer of insulating material on the substrate surface;

forming a gap in a top surface of the layer of ceramic insulating material by applying a first material removal process to the top surface; and

reshaping the gap by applying a second material removal process to the gap.

19. The method of claim 18, further comprising:

forming the gap in a top surface of the layer of ceramic insulating material by exposing the top surface to a first exposure of energy having a first parameter; and

reshaping the gap by exposing walls defining the gap to a second exposure of energy having a second parameter different than the first parameter.

20. The method of claim 19, wherein the energy used for both the first exposure and the second exposure is laser energy and the second exposure of laser energy has a wider beam footprint than that of the first exposure of laser energy.

21. The method of claim 19, wherein the energy used for both the first exposure and the second exposure is laser energy and the second exposure of laser energy has a pulsation frequency that is greater than that of the first exposure of laser energy.

22. The method of claim 19, wherein the first exposure of energy and the second exposure of energy utilize different forms of energy.

23. The method of claim 18, wherein the gap is reshaped to have a generally U-shaped bottom geometry.

24. A method of manufacturing an insulated component for use in an air stream environment, the method comprising:

applying a heat-inducing process to a top surface of a layer of ceramic insulation of a component to form a continuous groove bordered by a ridge along the top surface;

applying the heat-inducing process to form the continuous groove and ridge to follow a direction of a fluid stream over the top surface when the component is in use; and

using the component in the fluid stream without removing the ridge.

25. The method of claim 24, further comprising using a laser-engraving process to form the continuous groove to have a width at the top surface of between 25-125 microns.

26. The method of claim 24, further comprising:

forming a first plurality of continuous grooves to a first depth into the layer of ceramic insulation; and

forming a second plurality of continuous grooves to a second depth into the layer of ceramic insulation to define a plurality of failure planes in the layer of ceramic insulation.

27. A method of manufacturing an insulated component, the method comprising:

providing a substrate having a surface;

depositing a layer of ceramic insulating material on the substrate surface;

forming a first plurality of grooves to a first depth into the layer of ceramic insulating material; and

forming a second plurality of grooves to a second depth into the layer of ceramic insulating material.

28. The method of claim 27, further comprising forming the grooves each to have a width at a top surface of the layer of ceramic insulating material of less than 100 microns.

29. The method of claim 27, further comprising forming the grooves each to have a width at a top surface of the layer of ceramic insulating material of less than 75 microns.

30. The method of claim 27, further comprising forming the grooves each to have a width at a top surface of the layer of ceramic insulating material of less than 50 microns.

31. The method of claim 27, further comprising forming the grooves each to follow a path of an air stream flowing over a top surface of the layer of ceramic insulating material during use of the component.

32. A method of manufacturing an insulated component, the method comprising:

providing a substrate having a surface;

depositing a first layer of ceramic insulating material on the substrate surface;

forming a first plurality of grooves into the first layer of ceramic insulating material;

depositing a second layer of ceramic insulating material onto the first layer of ceramic insulating material; and

forming a second plurality of grooves into the second layer of ceramic insulating material.

33. The method of claim 32, further comprising forming each of the second plurality of grooves to have a width at a top surface of the second layer of ceramic insulating material in the range of 25-125 microns.

34. The method of claim 32, further comprising forming each of the second plurality of grooves to have a width at a top surface of the second layer of ceramic insulating material of less than 100 microns.

35. A method of manufacturing an insulated component, the method comprising:

applying a bond coating to a surface of a component;

applying a thermal barrier coating to the bond coating to create a bond coating/thermal barrier coating interface; and

decreasing a crack driving force at a location along the bond coating/thermal barrier coating interface by engraving respective grooves to respective partial depths into the thermal barrier coating on opposed sides of the location.